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ABSTRACT

The computer-based System of Interactive Guidance and Information (SIGI) was field tested and evaluated at five community colleges and one university. Developed by Educational Testing Service, SIGI assists students in the process of informed and rational career decision making. Interacting at a cathode-ray tube terminal with a computer, students examine their values, retrieve relevant information about occupations, obtain predictive data, formulate plans, and learn decision making strategies. Adopted as an integral part of the career guidance and planning program at the field test colleges, SIGI ran smoothly, was received enthusiastically by students and counselors, and proved effective in increasing students' mastery of career decision making competencies. This summary report briefly describes the research design and findings of the evaluation. (Author/BW)

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FIELD TEST AND EVALUATION OF A COMPUTER-BASED SYSTEM OF INTERACTIVE GUIDANCE AND INFORMATION

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ABSTRACT

A computer-based System of Interactive Guidance and Information (SIGI) was field-tested and evaluated at five community colleges and one university. Developed by Educational Testing Service, SIGI assists students in the process of informed and rational career decision-making. Interacting at a cathode-ray tube terminal with a computer, students examine their values, retrieve relevant information about occupations, obtain predictive data, formulate plans, and learn decision-making strategies. Adopted as an integral part of the career guidance and planning program at the field-test colleges, SIGI ran smoothly, was received enthusiastically by students and counselors, and proved effective in increasing students' mastery of career decision-making competencies.

SIGI: FIELD TEST AND EVALUATION OF A COMPUTER-BASED SYSTEM OF INTERACTIVE GUIDANCE AND INFORMATION

Description of the System

The physical features of SIGI include one of the PDP-11 series of computers manufactured by Digital Equipment Corporation and cathode-ray tube terminals with typewriter-like keyboards by which students can respond to messages and information displayed on the screen and can issue commands to the computer.

The content of SIGI consists of six interrelated subsystems called VALUES, LOCATE, COMPARE, PREDICTION, PLANNING, and STRATEGY. Taken in the order named, they comprise an organic system for career decision-making. The system starts with the student's own values--the rewards and satisfactions he* would like to realize through his occupation. In the Values system, he explores and examines his values, eventually assigning a numerical weight to each of ten occupational values to designate its importance to him. In Locate he commands the computer to assemble a list of occupations that meet or exceed his specifications on any set of five of those values at a time. In Compare he asks pointed questions and gets information on all dimensions of occupations of interest. Prediction allows him to calculate his chances of success in the coursework that is preparatory for a particular occupation. Planning shows him what he should expect to do to qualify for entry into an occupation; it maps pathways that lead to each occupation. Strategy, as the name implies, teaches decision rules based jointly on the rewards offered by an occupation and the risks of failing to get into it.

*The masculine pronoun is used in its generic sense for reasons of clarity and succinctness. It is intended, of course, to refer to both females and males.

When the student has gone through these subsystems in this order, he becomes an "initiate" and is turned loose to roam through SIGI at will. The resources of SIGI are now under his control: He knows the particular kind of information or assistance that resides in each subsystem and he can go to the subsystem that meets his needs as he perceives them at the moment.

Thus SIGI is both a career guidance system and an information system. Its aim is to produce an autonomous individual capable of making informed and rational decisions. The decision-maker's own examined values are the starting point for rationality. They mediate between his self-concept and the options available to him; they enable him to define and obtain information that is relevant.

The emphasis is not merely on the content of the decisions but on the process of decision-making. As the student progresses through SIGI, he learns to move freely within the structure of the system. In gaining control of the system, he develops competencies and masters strategies for rational behavior in the face of uncertainty--which may be the closest one can get to wisdom.

Research Design

The field test and evaluation of SIGI took place at six colleges representing great diversity in region, size, population, curriculum, and career guidance programs. The participating institutions were Delta College (University Center, Michigan), Eastfield College (Dallas, Texas), Illinois State University (Normal, Illinois), Mercer County Community College (Trenton, New Jersey), Pasadena City College (Pasadena, California), and Santa Fe Community College (Gainesville, Florida).

The evaluation of SIGI was two-pronged: formative and summative. The purpose of the formative evaluation was to improve the operation of SIGI. The purpose of the summative evaluation was to assess the impact of SIGI as a career guidance system. Sources of data included the students themselves, the counselors and other staff members, and the records of student interaction with the system.

Formative Evaluation

To improve the operation of SIGI, we needed to know specifically (a) what problems or gaps students found in the SIGI displays and content, (b) whether all elements of the system were used, (c) whether the "do-it-yourself" manuals could be used efficiently, (d) how valid the test-free Prediction system was, and (e) how SIGI could be integrated with the total career guidance program at each college.

Questionnaires distributed to counselors and to SIGI users included items on the clarity of displays and comprehensiveness of information. SIGI coordinators were asked to note any problems in the operation and use of the system. Individual students' interactions with the system, recorded by the computer, were studied to determine whether use of the system was comprehensive and logically consistent. Small samples of students at each college were interviewed to discover any additional problems or misconceptions.

The three manuals which had been developed to facilitate local control of the computer and the development of college-specific Prediction and Planning systems were evaluated during the course of their use by the field-test colleges. The manuals are the SIGI Manager's Guide, the Prediction System Manual, and the Planning System Manual.

The test-free Prediction system was evaluated not only in terms of absolute validities, but also in comparison with test-based predictions in studies done at two of the colleges where test scores were available. Observations, interviews, and counselor questionnaires were sources of information about how SIGI was meshed into the total career guidance program at each institution and of opinions about how it could best be utilized.

Summative Evaluation

The summative evaluation covered five major areas: (a) hardware reliability and cost, (b) students' reactions to SIGI, (c) the effects of SIGI on students' career decision-making, (d) the impact of SIGI on counseling activities and guidance problems, and (e) summary data on students' use of SIGI.

To determine the reliability of the SIGI hardware, we asked the field-test colleges to keep two sets of records of problems that affected the operation of SIGI during a three-month period. For one set, the computer operators noted each hardware problem on a special form which was mailed to ETS immediately. The SIGI monitors kept a separate log of all problems (including hardware malfunctions) that interfered with the normal operation of SIGI. This log was collected at the end of the test period.

Questionnaires were administered to random samples of SIGI users (experimentals) and students who had not yet used it (controls) to determine how SIGI affected the career decision-making of experimental students and how the experimentals differed from controls. In addition, between 10 and 17 students who had used SIGI were interviewed at each college to gain insight into their career decision-making and to assess changes they experienced as a result of using SIGI.

Questionnaires were also distributed to counselors who worked with SIGI users or who worked in the area of career counseling. The questionnaires were helpful in assessing the nature of the counselors' interactions with SIGI users, their acceptance of SIGI, changes in counseling activities attributable to SIGI, and the impact of SIGI on problems in guidance.

The computer collected descriptive data on the interaction of students with SIGI at each college by automatically summing responses to selected displays. These data were extremely useful in showing the extent and patterns of use.

Evaluative Highlights

Technical Aspects of the System

Hardware reliability. The SIGI hardware is all standard equipment that requires no special modification for SIGI. Its reliability is therefore completely independent of SIGI. All six field-test colleges had slightly different hardware configurations, depending on the number of terminals and the tasks imposed on the computer in addition to running SIGI. After the installation of SIGI and a short break-in period, all the systems ran smoothly with no malfunctions traceable to SIGI.

Cost. If the current cost of the hardware, software, and maintenance for a basic four-terminal system is totaled over a five-year period in which each terminal is operated 12 hours a day for 225 days per year (a rate of use easily sustained at the field-test sites), the cost per terminal hour would be $1.73. Over the five years, 13,500 students would be able to use SIGI four hours each; the cost of equipment would be $6.92 per student. If the same assumptions are applied to a 16-terminal system, the cost per terminal hour would be $0.90.

Software. The SIGI software, like the hardware, functioned satisfactorily. The time-sharing capability was realized before the delivery of the hardware to the first user college. The response time of the system was excellent at the only college with as many as five terminals and in a test at ETS with six terminals and additional peripherals all in use at the same time. The system was free of bugs, and the reprogrammed Prediction system, which permits valid predictions without reliance on test scores, operated successfully at all colleges.

Courseware

Operation. The courseware--the sequences of displays that students actually follow--also proved entirely adequate. A large proportion of students expressed interest in the occupations retrieved for them on the basis of their values. Almost all students were able to operate the system without outside assistance and to understand what they were doing.

Occupational information. Both students and counselors thought that the quality of the occupational information was high. Three-quarters of the students indicated that it was better than information from other sources, and only 1% thought it was worse. The information covered all of the areas that students were interested in except for data about local salaries and opportunities. The SIGI data base included about 90% of the occupations that students named as being of interest to them. Nevertheless, plans continue for adding new occupations.

Acceptance by students. Students gave SIGI high grades--86% graded it A or B on how interesting it was, 90% on how clear it was, and 87% on its overall "goodness." The aspects of SIGI that concerned clarifying values, identifying occupations that fit values, and finding occupational information

received the most A's and B's, and aspects that concerned prediction and planning received the fewest. Enthusiasm for SIGI was high, and over 70% of the SIGI users recommended SIGI to their friends. Over 60% of them wanted to use the system again in the future.

Reading level. Although some students complained about the quantity of reading in SIGI, 92% of the students found the vocabulary and style "Just right." Only 1% found them "Too difficult." Only two counselors out of 45 indicated that the reading level was too hard for their students, one saying that deaf students experienced difficulty with some of the text and the other saying that foreign students experienced some difficulty.

Freedom from bias. Over 98% of the students thought that SIGI was free from sexual, racial, or other bias. Forty-five out of 49 counselors also thought that SIGI was bias-free. Since the students expressing this opinion reflected the sexual, racial, and ethnic composition of the college population, it appears that nearly all members of all groups, including women and minorities, believe that SIGI is unbiased.

Problems and revisions. No single aspect of SIGI stood out as a problem for the SIGI users. Responses to questions about problems were scattered. Operating with a single-terminal system appears to create problems in scheduling and in causing students to feel rushed. For the most part, students liked Values, Locate, and Compare more than Prediction, Planning, and Strategy; but the systems they would most like to use when they return were Prediction and Planning.

Few revisions seem necessary in light of students' acceptance of SIGI. We intend, however, to expand the occupational base. We would also like to devise a procedure that would allow a college to add local occupational

information. Three technical changes are under way: increasing the number of occupations that can be retrieved at one time in Locate, making all printouts optional, and simplifying the method of selecting occupations at various points in the interaction. We would also like to make a few refinements in the courseware.

Effectiveness of "Do-It-Yourself" Manuals

All three manuals prepared by ETS to permit operation with a minimum of technical assistance proved effective. The manuals are the SIGI Manager's Guide, the Prediction System Manual, and the Planning System Manual. The SIGI Manager's Guide was sufficiently detailed to enable not just computer operators but even technically unsophisticated staff members at some colleges to handle all details of the day-to-day operation of SIGI.

The Prediction System Manual and Planning System Manual also proved sufficient. Following the detailed procedures in the manuals, each college was able successfully to collect the data that result in the course predictions in the Prediction system and to construct the displays that constitute their unique Planning systems. At all colleges the data collection and preparation were done by persons without special training in computer information systems or occupational information. The work was done by paraprofessionals and graduate students working with a regular counselor or by counselors themselves. Extensive consultation with the SIGI staff was not required. All systems ran smoothly and appeared to be of high quality.

Development of the Prediction and Planning systems produced a dividend for some colleges in the form of feedback. Colleges were informed about changes in the distribution of grades in key courses and about instances when faculty selected grade factors that turned out to have little correla-

tion with final grades. This information has stimulated reviews of policies concerning grades. The research required for the Planning system has also been beneficial, resulting in extensive revision of the curriculum at one of the colleges and some changes at others.

Another manual, the Counselor's Handbook for SIGI, was deemed useful as a guide to follow-up sessions with students who had used SIGI and also as a resource for career development courses.

Development of Test-Free Prediction System

Development of a Prediction system that would be independent of test scores was successful. A test-free system was necessary because only one field-test college had a mandatory testing program. As a result of this work, the SIGI predictions are based on nontest predictor variables, such as previous academic performance, the students' own self-ratings on behaviors associated with good grades in a particular course, and the students' own informed estimates of their final grades. The predictions may also be based on test scores when test scores are available. Studies done at two of the colleges where test scores were available show that validities obtained with nontest variables are generally as high as those obtained with test scores and are sometimes higher.

Test-free predictions offer some benefits to the college. Predictions are possible, at least for purposes of guidance, even in the absence of a testing program. Some courses that are hard to predict with the usual measures of quantitative and verbal ability may be successfully predicted by nontest variables that are especially selected to reflect the content of the course. Students become active rather than passive participants in the

prediction process and for this reason may find it more acceptable than a testing program. Faculty are induced to examine and make explicit the bases of their grades. Faculty also benefit from feedback showing them how well the grades they actually awarded are correlated with the factors they specified as being important.

Usage of the System

Internal consistency. Summary data collected by the computer show that SIGI had a high degree of internal consistency. The values that were most heavily weighted in the Values system were most frequently selected for retrieval of occupations in the Locate system; occupations that were retrieved most often in Locate were generally among those most frequently selected for examination in the Compare and Strategy systems.

Sufficiency of individual subsystems. The subsystems did what they were designed to do. Each of the ten values and each of the six interest fields were important to some students, with wide variation in the weights assigned to each value. Each of the ten values was selected for use by some students in the search for compatible occupations in the Locate system. Every occupation in SIGI was retrieved by students at one or another of the colleges, indicating a wide range in the values/specifications used by the students and corresponding differentiation in characteristics of occupations. As expected, professional occupations, such as Teacher, Psychologist, Lawyer, Physician, Dentist, and Speech Pathologist, were retrieved more frequently than non-professional ones, for the professional occupations tend to rate higher on the values given the greatest weight by these students. But students were selective, as indicated by the facts that all occupations were retrieved and

that at one college with a high proportion of older students, more nonprofessional occupations were retrieved than at the other colleges. Similarly, every occupation in SIGI was selected for examination in the Compare system, and every question was asked. Most of the programs for which predictions were available were called for in the Prediction systems, and each of the optional questions that students could ask about the prediction process was of interest to large numbers of students. Also, the data from the Strategy system show that students were influenced by information about the desirability and risks associated with occupations they had selected for study.

Impact on Students

Conclusions drawn from interviews. Interviewers looked for evidence of autonomy and rationality in the students' comments on their SIGI experience. They believed that the students had acquired a vocabulary for communicating about career choice. Students tended to discuss occupations in terms of the SIGI values. The discovery that values provided a basis for investigation as well as a medium for communication gave them an awareness of structure in decision-making. They saw the logic of weighting their values and then using the ensuing knowledge as a means for assessing occupations. Their behavior seemed purposive both at the intellectual and behavioral levels; they seemed to have reasons for liking or disliking an occupation, and they often took steps toward a goal, such as changing programs, seeking outside help, or getting additional information. Also, the students had moved perceptibly forward in the process of making career decisions. When they felt committed to a specific occupation, either the one they had had in mind before going on SIGI or another, they felt, when they finished, that the commitment was well-grounded on information. When they were not committed to a specific occupation at the beginning, progress often consisted of an awareness that reasonable

options existed and that they had learned an approach to assessing and either retaining or discarding options.

On the negative side, interviewers did not find that students had completely mastered the SIGI algorithm for decision-making. Although the students were following the model and recognized that it was rational, many of them would have had difficulty describing it to someone else. The interviewers did not pick up much evidence that students were able to generalize from the particular SIGI experience to other kinds of decisions.

Conclusions drawn from questionnaires. Comparisons of responses to relevant questions on the control and experimental questionnaires show numerous significant differences between students who used SIGI and those who did not. More differences were found at some colleges than at others. Yet there were great similarities in the way students responded to SIGI, despite the fact that the colleges were geographically dispersed and were also quite dissimilar in other respects. Pooling the data for all colleges shows significant differences ($p < .01$) between experimentals and controls in that SIGI users displayed a greater knowledge of the rewards and satisfactions they want from an occupation, had more definite career plans, thought they could predict their grades better, knew better which program to enroll in for their occupational goal, had greater confidence in their career decision-making ability, used the college reference library more frequently, talked with guidance counselors more often, used career-related audiovisual materials more frequently, rated themselves higher as decision-makers and higher in their knowledge of occupations, had more accurate knowledge of the occupation they might enter, had seen a counselor in greater numbers within the previous two weeks, and were more willing to interact with a computer. Moreover, they would be

($p < .05$) less inclined to follow the advice of parents and friends, were less confused by conflicting advice, were less persuaded that knowledge of marriage plans was crucial to career decision-making, and had a clearer knowledge of their values and goals.

Impact on Guidance Program

Acceptance. Responses to the counselor questionnaire show a high degree of acceptance of computer-based guidance in general and SIGI in particular. Counselors rejected by a wide margin the notion that computer-based guidance was a fad or a threat to them, and accepted by a wide margin the idea that such systems would relieve them of routine duties and would help students make career decisions.

Use of the system. Only one counselor out of 57 indicated that he or she had not actually referred students to SIGI. All the counselors who observed student response to SIGI thought it was favorable.

Impact on problem areas. Counselors indicated that SIGI had had a favorable impact on one or another of the areas identified as major or minor problems. More counselors thought that SIGI had had an impact on getting students to read occupational information and on keeping it up to date, which were the most serious problem areas, than thought it had had an impact on less serious areas. But each problem was designated by some counselor as diminishing in seriousness because of the impact of SIGI.

Impact on counseling activities. Counselors do not perceive SIGI as taking over the burden of career counseling. Rather, it improves the quality of counseling sessions. Students arrive for their appointments with a better background, with better formulated goals, with more occupations in mind, and with a more structured approach than do non-SIGI users. Counselors do not have to spend time providing background and educating students in basic

knowledge. Consequently, the session can be devoted to matters of substance and the student can get more out of it.

How SIGI Fits in the Guidance Program

Although the guidance programs at the six colleges differed in many respects, as did the colleges themselves, there were great similarities in the way students responded to SIGI and the impact that SIGI had on their career decision-making. This fact suggests that SIGI is sufficiently flexible to be fitted into the counseling practices of a college in various ways and still remain effective. The "best" way of using SIGI, therefore, may be the way that best suits the style of the college.

Nevertheless, students prefer a combination of SIGI and counselors for help in most activities directed toward career choice. Counselors prefer a configuration in which they will play a part in the students' choices. Therefore it seems likely that a configuration which allows SIGI and a counselor to supplement each other may be the most satisfying to all parties, if not the most effective. SIGI's role in this configuration is to provide an algorithm for decision-making, a vocabulary for communication, the basic steps of values clarification, the retrieval of relevant information, and so on. The counselors' role is to interpret, explain, and supplement, as well as to help with personal problems. Using SIGI in conjunction with a course or seminar seems a logical arrangement because of the economies that can be obtained through group counseling. The activities of the career information center should complement the SIGI-counselor combination so that SIGI, counselor, and center form a comprehensive guidance program. SIGI should also be made available to students ad libitum.

Independent Evaluations

In addition to the research and evaluation carried out by ETS, other studies of the effects of SIGI were conducted independently at a number of the user sites, most of them by the colleges themselves. The results of these studies, undertaken because the colleges wanted to find out in their own terms how well SIGI was meeting their needs, reiterate the main themes emerging from this report: satisfaction with SIGI by students and counselors, evidence of effectiveness, however defined, in meeting stated objectives; side effects in enhancing counselors' contributions to students' career decision-making. The evidence appears not only in questionnaires and tests; it comes also from such unobtrusive measures as long waiting lists to use SIGI, the high proportion of users who have been referred by their friends and who spread the word to other friends, the development of courses and various activities at career planning centers to focus on SIGI and integrate it into the total career guidance program, the enthusiastic reception of visitors, and eagerness to see SIGI used as widely as possible.

The fact that the presence of SIGI has prompted independent evaluation and research studies on campuses is itself a bonus. It is useful for colleges to define their objectives in career guidance, to plan programs, to collect and analyze evidence of effectiveness. Thus, SIGI may serve as a catalyst in the process of rational and informed decision-making by the colleges themselves as they strive to meet the career development needs of students.